

Evolution of the Optical Properties of Smoke Plumes From Biomass Burning in a Three-Dimensional Transport Model and Comparisons to *In Situ* and Remote Sensing Observations From SAFARI 2000

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Abstract

We model the evolution of biomass burning aerosols and investigate their optical properties. Our model is an offline three-dimensional aerosol and microphysical transport model driven by assimilated meteorology from the NCEP/NCAR reanalyses and constrained with measurements collected during the Southern African Regional Science Initiative campaign (SAFARI 2000). Detailed simulations were conducted to examine the model's sensitivity to aerosol emissions and microphysical processes, and to see how well our model aerosol optical properties compare to measurements near and far from the smoke sources. Here we investigate the model sensitivity to the diurnal cycle and injection altitude of aerosol emissions. In addition, we test the sensitivity of the model aerosol optical properties to our choice of initial aerosol particle size distribution and the effects of particle coagulation, relative humidity and refractive indices. Modeled smoke aerosol optical thickness, aerosol extinction, angstrom exponent and single scattering albedo are compared to satellite, aircraft and ground-based observations made over central and southern Africa. Air mass back-trajectories at various locations were also conducted and compared to our model results to identify sources. The results from this study will be useful in future applications relating to the transport and evolution of biomass burning aerosols by testing source functions and illuminating microphysical processes that must be treated in models.

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